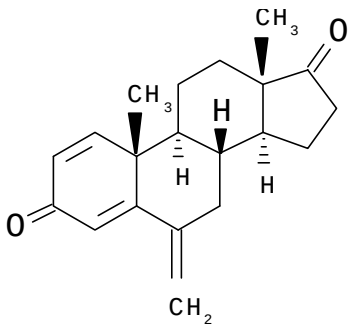
AROMASINÒ
(exemestane) Tablets

DESCRIPTION

AROMASIN® Tablets for oral administration contain 25 mg of exemestane, an irreversible, steroidal aromatase inactivator. Exemestane is chemically described as 6-methylenandrosta-1,4-diene-3,17 -dione. Its molecular formula is $C_{20}H_{24}0_2$ and its structural formula is as follows:



The active ingredient is a white to slightly yellow crystalline powder with a molecular weight of 296.41. Exemestane is freely soluble in N, N-dimethylformamide, soluble in methanol, and practically insoluble in water.

Each AROMASIN Tablet contains the following inactive ingredients: mannitol, crospovidone, polysorbate 80, hydroxypropyl methylcellulose, colloidal silicon dioxide, microcrystalline cellulose, sodium starch glycolate, magnesium stearate, simethicone, polyethylene glycol 6000, sucrose, magnesium carbonate, titanium dioxide, methylparaben, and polyvinyl alcohol.

CLINICAL PHARMACOLOGY

Mechanism of Action

Breast cancer cell growth may be estrogen-dependent. Aromatase(exemestane) is the principal enzyme that converts androgens to estrogens both in pre- and postmenopausal women. While the main source of estrogen (primarily estradiol) is the ovary in premenopausal women, the principal source of circulating estrogens in postmenopausal women is from conversion of adrenal and ovarian androgens (androstenedione and testosterone) to estrogens (estrone and

estradiol) by the aromatase enzyme in peripheral tissues. Estrogen deprivation through aromatase inhibition is an effective and selective treatment for some postmenopausal patients with hormone-dependent breast cancer.

Exemestane is an irreversible, steroidal aromatase inactivator, structurally related to the natural substrate androstenedione. It acts as a false substrate for the aromatase enzyme, and is processed to an intermediate that binds irreversibly to the active site of the enzyme causing its inactivation, an effect also known as "suicide inhibition." Exemestane significantly lowers circulating estrogen concentrations in postmenopausal women, but has no detectable effect on adrenal biosynthesis of corticosteroids or aldosterone. Exemestane has no effect on other enzymes involved in the steroidogenic pathway up to a concentration at least 600 times higher than that inhibiting the aromatase enzyme.

Pharmacokinetics

Following oral administration to healthy postmenopausal women, exemestane is rapidly absorbed. After maximum plasma concentration is reached, levels decline polyexponentially with a mean terminal half-life of about 24 hours. Exemestane is extensively distributed and is cleared from the systemic circulation primarily by metabolism. The pharmacokinetics of exemestane are dose proportional after single (10 to 200 mg) or repeated oral doses (0.5 to 50 mg). Following repeated daily doses of exemestane 25 mg, plasma concentrations of unchanged drug are similar to levels measured after a single dose.

Pharmacokinetic parameters in postmenopausal women with advanced breast cancer following single or repeated doses have been compared with those in healthy, postmenopausal women. Exemestane appeared to be more rapidly absorbed in the women with breast cancer than in the healthy women, with a mean t_{max} of 1.2 hours in the women with breast cancer and 2.9 hours in the healthy women. After repeated dosing, the average oral clearance in women with advanced breast cancer was 45% lower than the oral clearance in healthy postmenopausal women, with corresponding higher systemic exposure. Mean AUC values following repeated doses in women with breast cancer (75.4 ng·h/mL) were about twice those in healthy women (41.4 ng·h/mL).

Absorption: Following oral administration of radiolabeled exemestane, at least 42% of radioactivity was absorbed from the gastrointestinal tract. Exemestane plasma levels increased by approximately 40% after a high-fat breakfast.

Distribution: Exemestane is distributed extensively into tissues. Exemestane is 90% bound to plasma proteins and the fraction bound is independent of the total concentration. Albumin and α_1-acid glycoprotein both contribute to the binding. The distribution of exemestane and its metabolites into blood cells is negligible.

Metabolism and Excretion: Following administration of radiolabeled exemestane to healthy postmenopausal women, the cumulative amounts of radioactivity excreted in urine and feces were similar (42 ± 3% in urine and 42 ± 6% in feces over a 1-week collection period). The amount of drug excreted unchanged in urine was less than 1% of the dose.

Exemestane is extensively metabolized, with levels of the unchanged drug in plasma accounting for less than 10% of the total radioactivity. The initial steps in the metabolism of exemestane are oxidation of the methylene group in position 6 and reduction of the 17-keto group with subsequent formation of many secondary metabolites. Each metabolite accounts only for a limited amount of drug-related material. The metabolites are inactive or inhibit aromatase with decreased potency compared with the parent drug. One metabolite may have androgenic activity (see Pharmacodynamics, Other Endocrine Effects). Studies using human liver preparations indicate that cytochrome P-450 3A4 (CYP 3A4) is the principal isoenzyme involved in the oxidation of exemestane.

Special Populations

Geriatric: Healthy postmenopausal women aged 43 to 68 years were studied in the pharmacokinetic trials. Age-related alterations in exemestane pharmacokinetics were not seen over this age range.

Gender: The pharmacokinetics of exemestane following administration of a single, 25-mg tablet to fasted healthy males (mean age 32 years) were similar to the pharmacokinetics of exemestane in fasted healthy postmenopausal women (mean age 55 years).

Race: The influence of race on exemestane pharmacokinetics has not been evaluated.

Hepatic Insufficiency: The pharmacokinetics of exemestane have been investigated in subjects with moderate or severe hepatic insufficiency (Childs-Pugh B or C). Following a single 25-mg oral dose, the AUC of exemestane was approximately 3 times higher than that observed in healthy volunteers. (See Precautions)

Renal Insufficiency: The AUC of exemestane after a single 25-mg dose was approximately 3 times higher in subjects with moderate or severe renal insufficiency (creatinine clearance <35 mL/min/1.73 m^2) compared with the AUC in healthy volunteers (see Precautions).

Pediatric: The pharmacokinetics of exemestane have not been studied in pediatric patients.

Drug-Drug Interactions

Exemestane is metabolized by cytochrome P-450 3A4 (CYP 3A4) and aldoketoreductases. It does not inhibit any of the major CYP isoenzymes, including CYP 1A2, 2C9, 2D6, 2E1, and 3A4. In a clinical pharmacokinetic study, ketoconazole showed no significant influence on the pharmacokinetics of exemestane. Although no other formal drug-drug interaction studies have been conducted, significant effects on exemestane clearance by CYP isoenzymes inhibitors appear unlikely. However, a possible decrease of exemestane plasma levels by known inducers of CYP 3A4 cannot be excluded.

Pharmacodynamics

Effect on Estrogens: Multiple doses of exemestane ranging from 0.5 to 600 mg/day were administered to postmenopausal women with advanced breast cancer. Plasma estrogen (estradiol, estrone, and estrone sulfate) suppression was seen starting at a 5-mg daily dose of exemestane, with a maximum suppression of at least 85% to 95% achieved at a 25-mg dose. Exemestane 25 mg daily reduced whole body aromatization (as measured by injecting radiolabeled androstenedione) by 98% in postmenopausal women with breast cancer. After a

single dose of exemestane 25 mg, the maximal suppression of circulating estrogens occurred 2 to 3 days after dosing and persisted for 4 to 5 days.
Effect on Corticosteroids: In multiple-dose trials of doses up to 200 mg daily, exemestane selectivity was assessed by examining its effect on adrenal steroids. Exemestane did not affect cortisol or aldosterone secretion at baseline or in response to ACTH at any dose. Thus, no glucocorticoid or mineralocorticoid replacement therapy is necessary with exemestane treatment.
Other Endocrine Effects: Exemestane does not bind significantly to steroidal receptors, except for a slight affinity for the androgen receptor (0.28% relative to dihydrotestosterone). The binding affinity of its 17-dihydrometabolite for the androgen receptor, however, is 100-times that of the parent compound. Daily doses of exemestane up to 25 mg had no significant effect on circulating levels of testosterone, androstenedione, dehydroepiandrosterone sulfate, or 17-hydroxy-progesterone. Increases in testosterone and androstenedione levels have been observed at daily doses of 200 mg or more. A dose-dependent decrease in sex hormone binding globulin (SHBG) has been observed with daily exemestane doses of 2.5 mg or higher. Slight, nondose-dependent increases in serum lutenizing hormone (LH) and follicle-stimulating hormone (FSH) levels have been observed even at low doses as a consequence of feedback at the pituitary level.

CLINICAL STUDIES

Exemestane 25 mg administered once daily was evaluated in a randomized double-blind, multicenter, multinational comparative study and in two multicenter single-arm studies of postmenopausal women with advanced breast cancer who had disease progression after treatment with tamoxifen for metastatic disease or as adjuvant therapy. Some patients also have received prior cytotoxic therapy, either as adjuvant treatment or for metastatic disease.

The primary purpose of the three studies was evaluation of objective response rate (complete response [CR] and partial response [PR]). Time to tumor progression and overall survival were also assessed in the comparative trial. Response rates were assessed based on World Health Organization (WHO) criteria, and in the comparative study, were submitted to an external review committee that was blinded to patient treatment. In the comparative study, 769 patients were randomized to receive AROMASIN (exemestane) 25 mg once daily (N = 366) or megestrol acetate 40 mg four times daily (N = 403). Demographics and baseline characteristics are presented in Table1.

Table 1. Demographics and Baseline Characteristics from the Comparative Study of Postmenopausal Women with Advanced Breast Cancer Whose Disease Had Progressed after Tamoxifen Therapy

Parameter	AROMASIN (N = 366)	Megestrol Acetate (N = 403)
Median Age (range)	65 (35-89)	65 (30-91)
ECOG Performance Status		
0	167 (46%)	187 (46%)
1	162 (44%)	172 (43%)
2	34 (9%)	42 (10%)
Receptor Status		
ER and/or PgR +	246 (67%)	274 (68%)
ER and PgR unknown	116 (32%)	128 (32%)
Responders to prior tamoxifen	68 (19%)	85 (21%)
NE for response to prior tamoxifen	46 (13%)	41 (10%)
Site of Metastasis		
Visceral ± other sites	207 (57%)	239 (59%)
Bone only	61 (17%)	73 (18%)
Soft tissue only	54 (15%)	51 (13%)
Bone & soft tissue	43 (12%)	38 (9%)
Measurable Disease	287 (78%)	314 (78%)
Prior Tamoxifen Therapy		
Adjuvant or Neoadjuvant	145 (40%)	152 (38%)
Advanced Disease, Outcome		
CR, PR or SD≥ 6 months	179 (49%)	210 (52%)
SD< 6 months, PD or NE	42 (12%)	41 (10%)
Prior Chemotherapy		
For advanced disease ± adjuvant	58 (16%)	67 (17%)
Adjuvant only	104 (28%)	108 (27%)
No chemotherapy	203 (56%)	226 (56%)

The efficacy results from the comparative study are shown in Table 2. The objective response rates observed in the two treatment arms showed that AROMASIN(exemestane) was not different from megestrol acetate. Response rates for exemestane from the two single-arm trials were 23.4% and 28.1%.

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